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Takamura

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(54) **CONNECTOR FOR ELECTRONIC DEVICE**

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Mar. 7, 2014 (JP) 2014-045474

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H01R 13/40 (2006.01)
H01R 13/24 (2006.01)
H01R 13/62 (2006.01)
H01R 24/50 (2011.01)

(52) **U.S. Cl.**
CPC ***H01R 13/2407*** (2013.01); ***H01R 13/2414*** (2013.01); ***H01R 13/62*** (2013.01); *H01R 24/50* (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/5208; H01R 13/5219
USPC 439/587, 271, 620, 0.15, 76.1, 76.2
See application file for complete search history.

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(57) **ABSTRACT**

A connector for an electronic device is provided. The connector includes a connector housing to be connected to the electronic device, a terminal fitting held by the connector housing, and a relay terminal to be held between a distal end of the terminal fitting and the contact portion of the electronic device when the connector housing is connected to the electronic device. The relay terminal includes an electrically-insulating member and an electrically-conductive portion. The electrically-conductive portion includes a conductor provided on the electrically-insulating member to electrically couple a contact portion of the electronic device and the terminal fitting to each other. The conductor extends in a direction intersecting a center axis of the connector in a state in which the conductor is in contact with at least one of the contact portion of the electronic device and the terminal fitting.

8 Claims, 8 Drawing Sheets

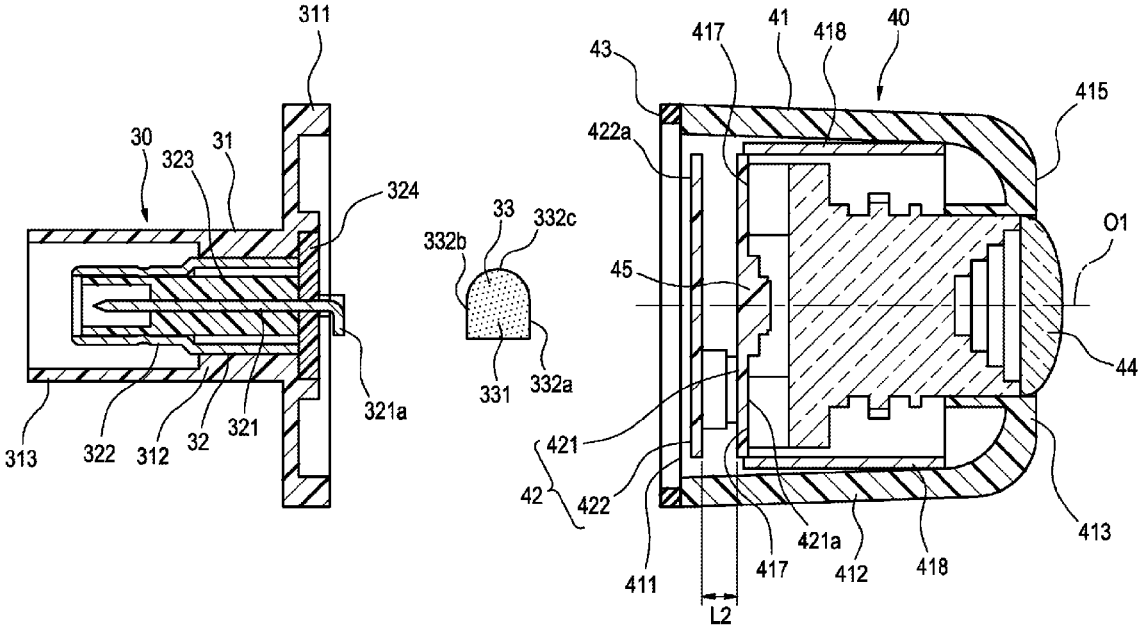


FIG. 1

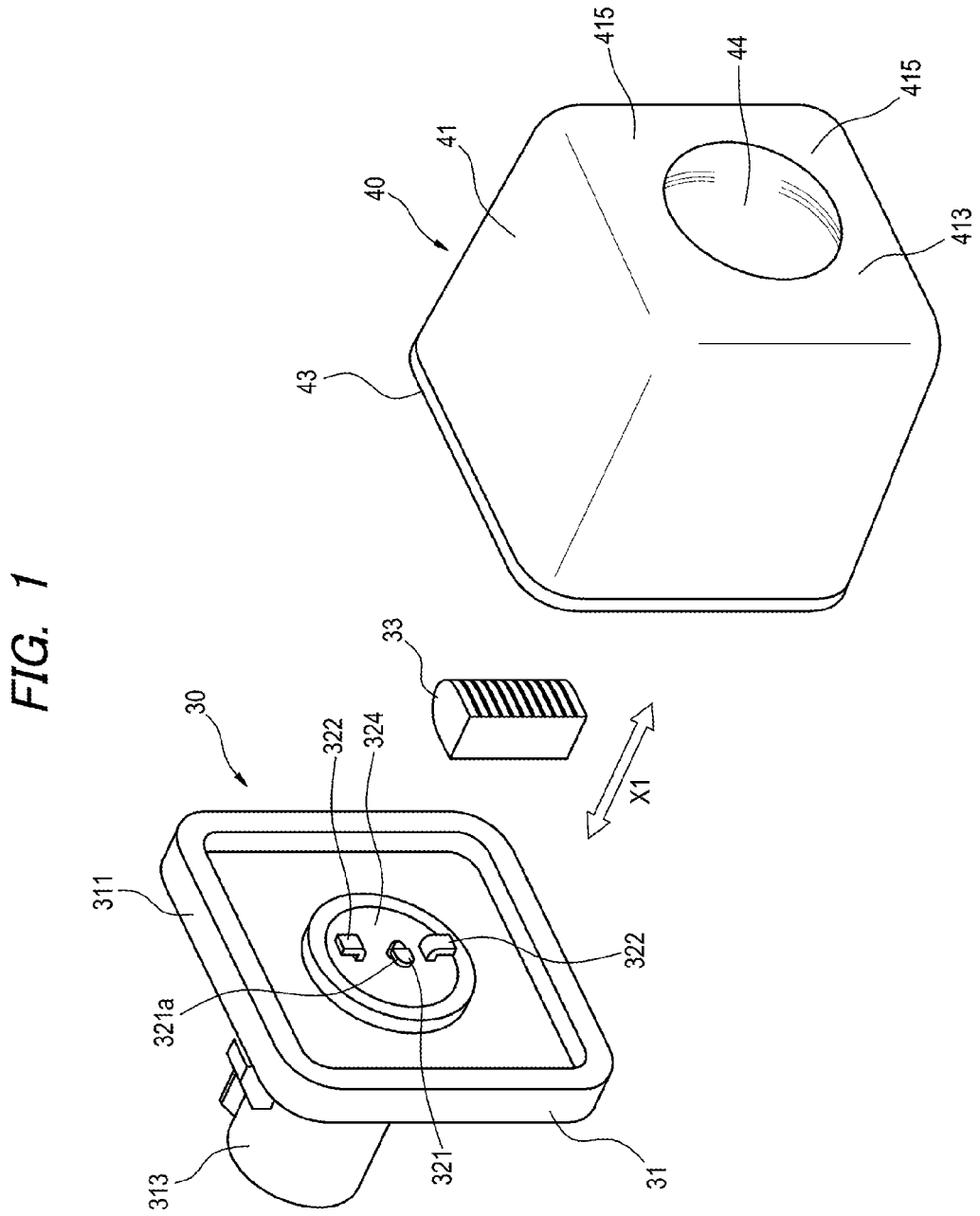


FIG. 2

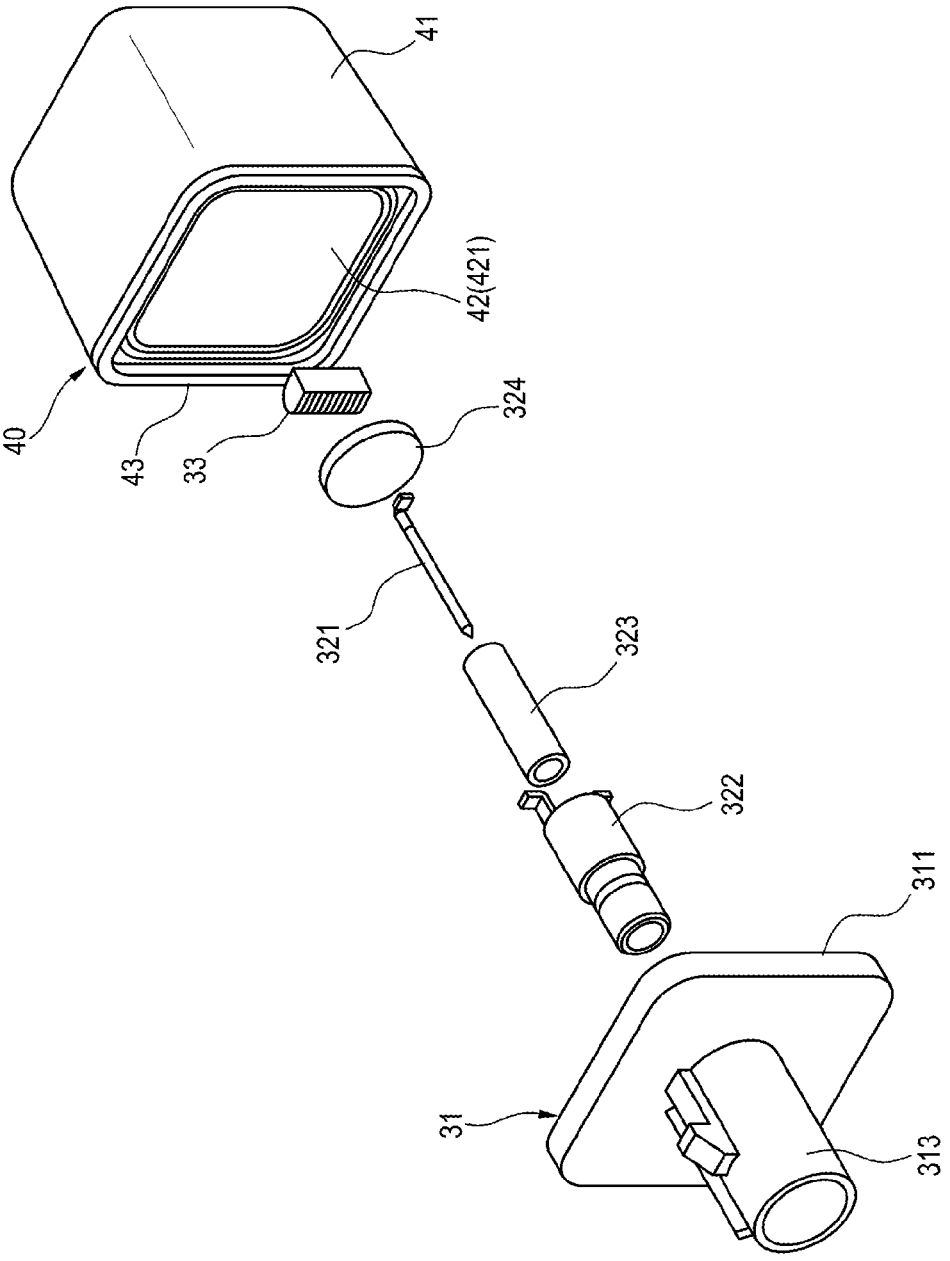


FIG. 3

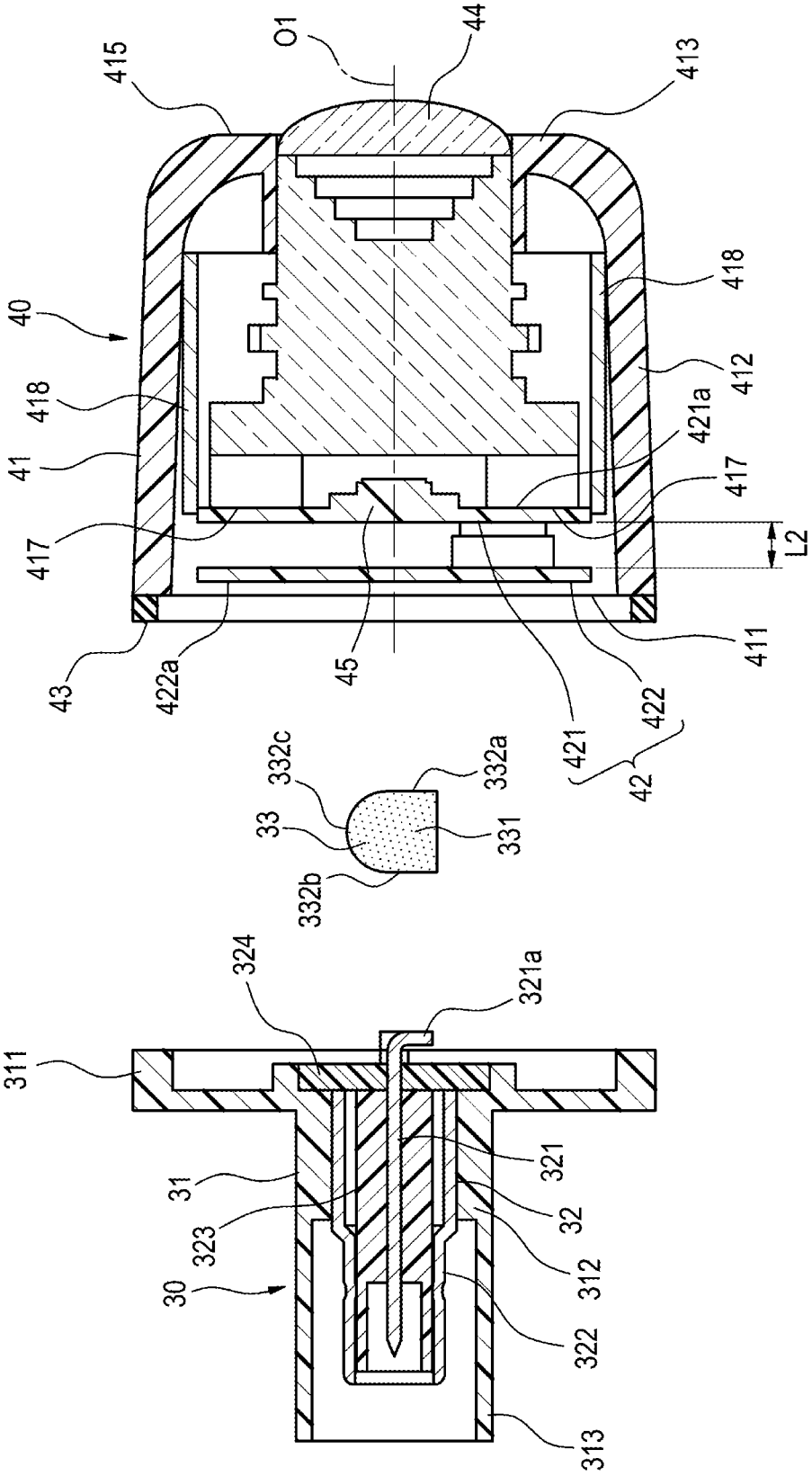

O1
44
415
413
418
40
412
418
421a
41
417
417
L2
411
43
422a
45
422
421
42
332c
332a
33
331
332b
324
321a
311
321
31
32
323
312
30
322
313

FIG. 4

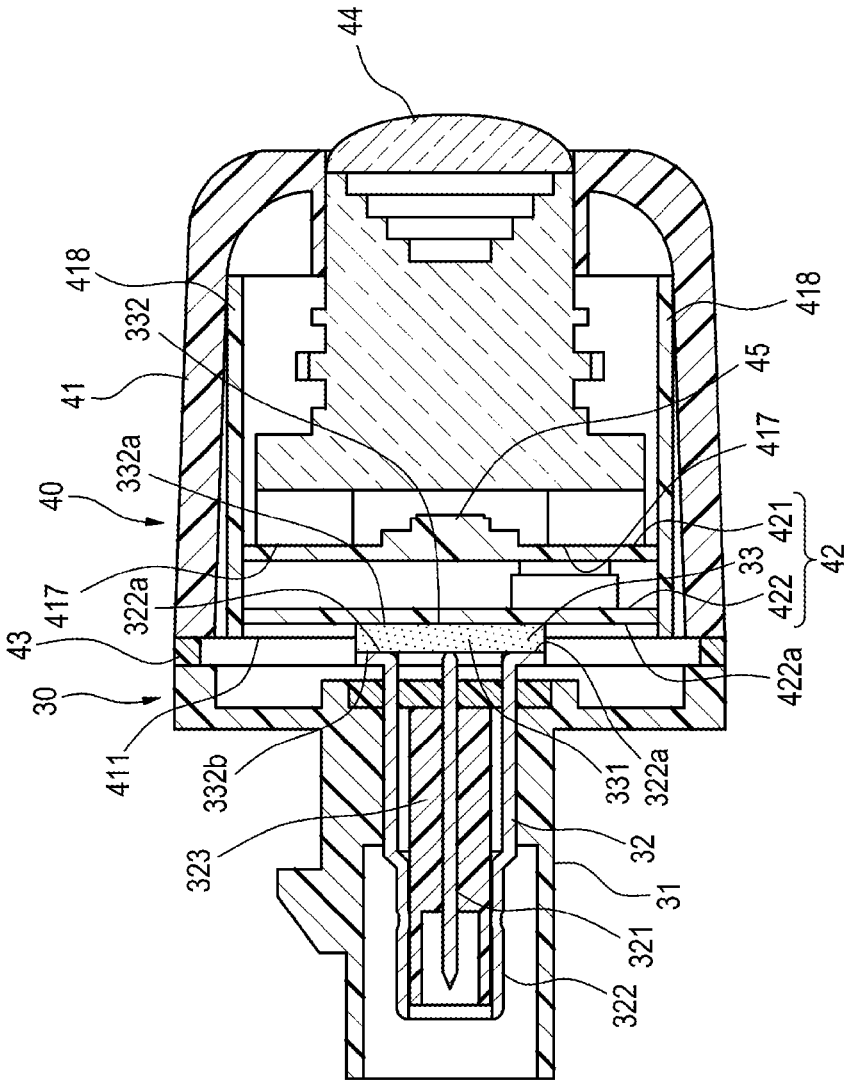

44
418
332
41
40
332a
417
322a
43
30
411
332b
323
418
45
417
421
42
33
422
422a
331
322a
32
31
321
322

FIG. 5

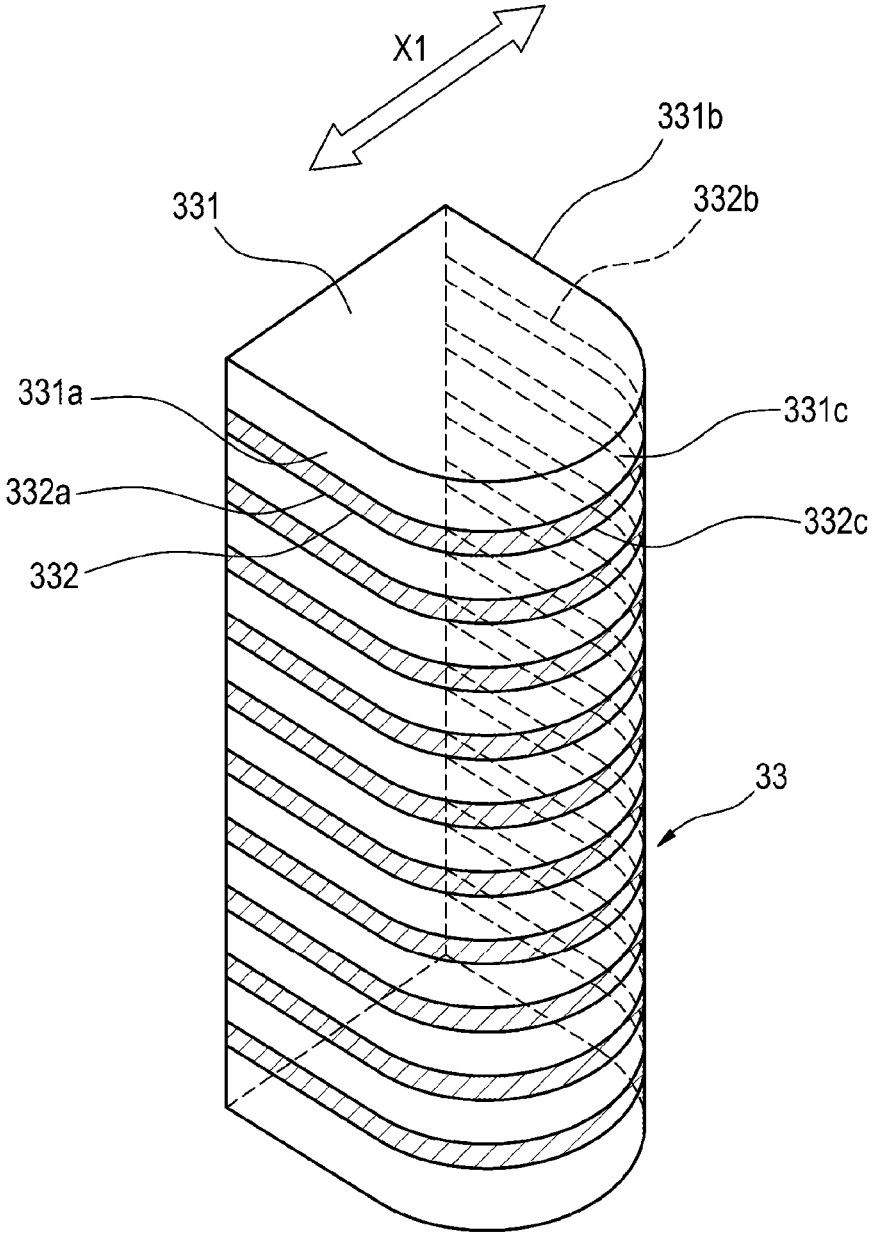


FIG. 6

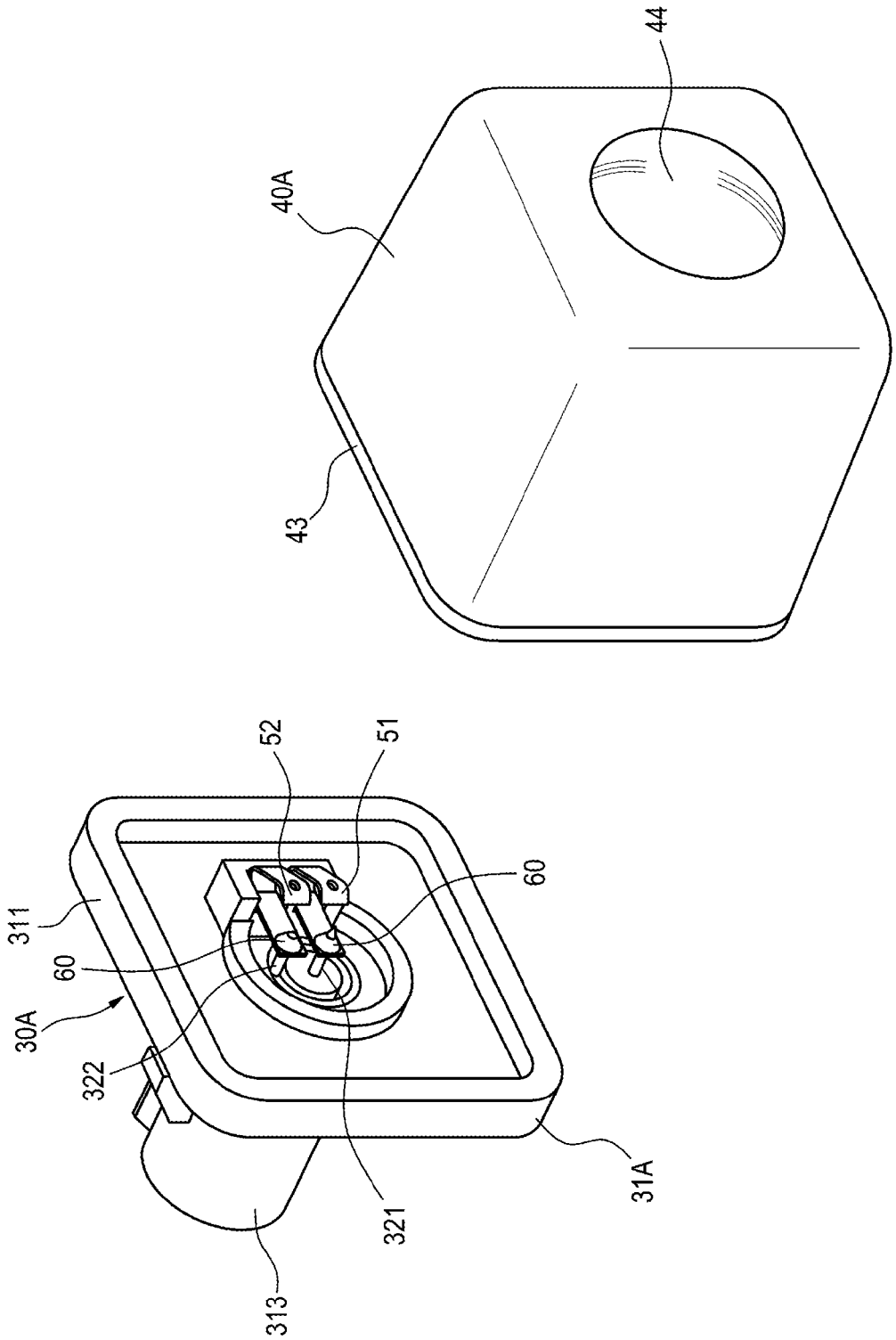


FIG. 7

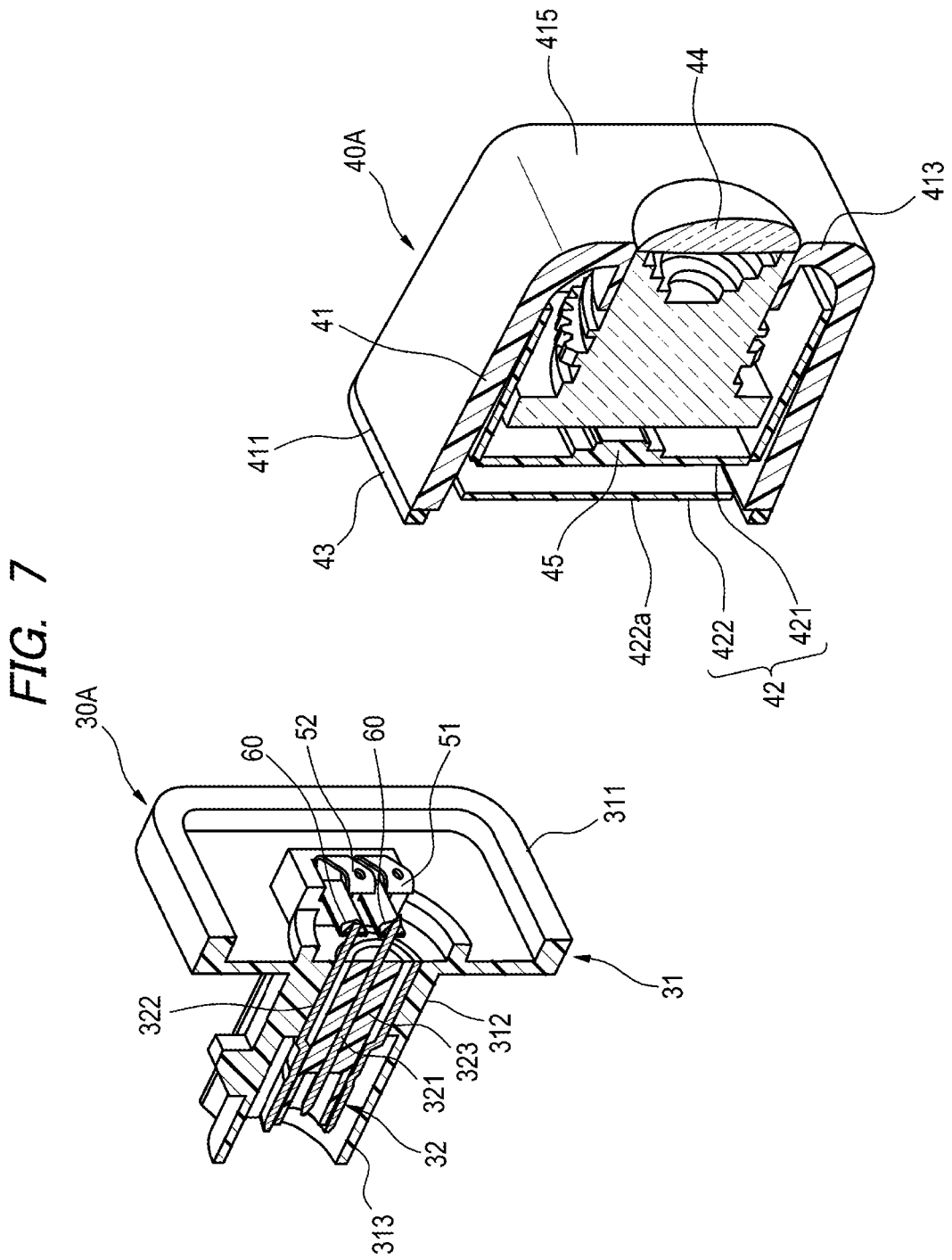
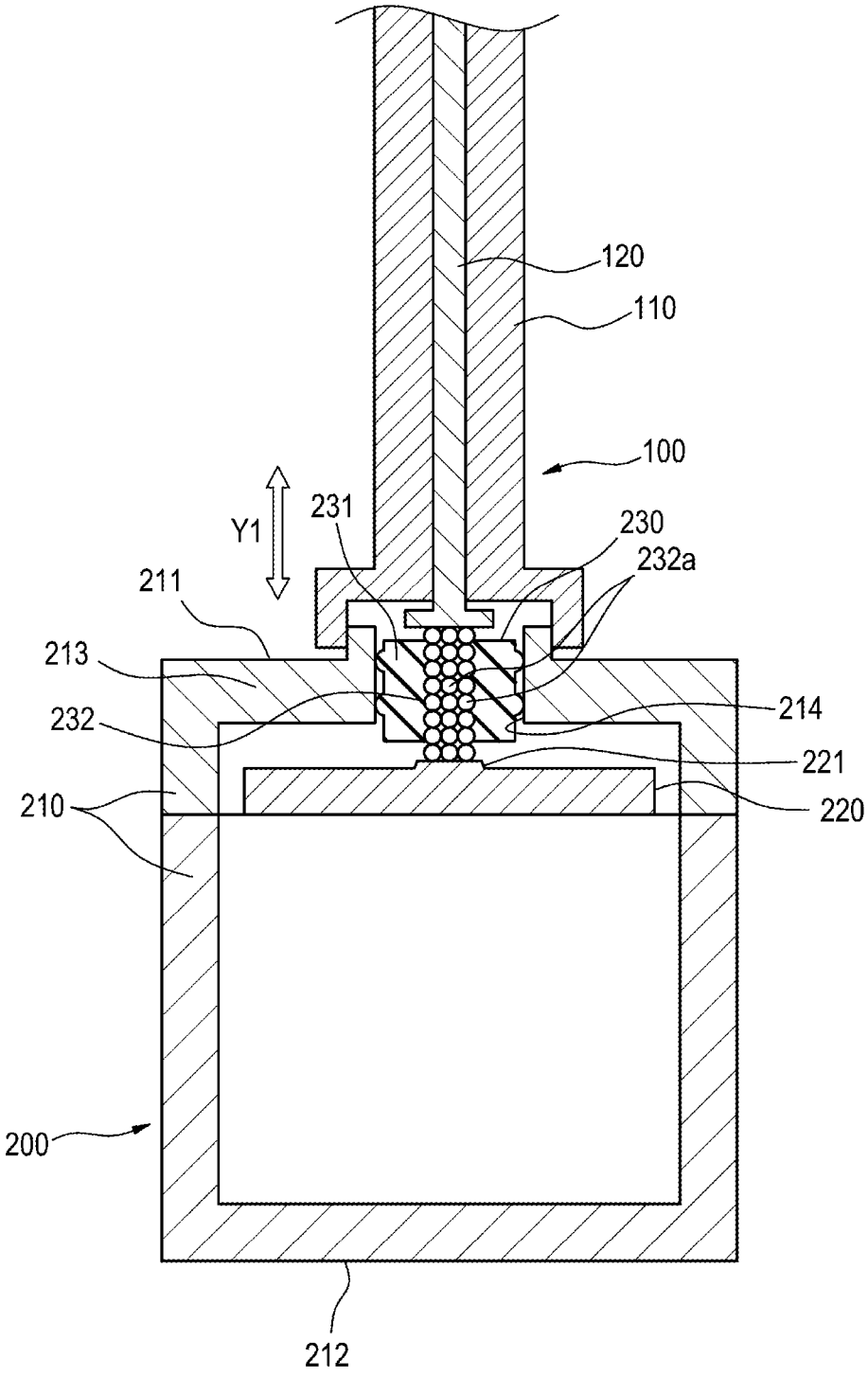

415
44
40A
413
41
411
43
45
422a
422
421
42
30A
60
52
60
51
311
322
312
323
321
32
313
31

FIG. 8



CONNECTOR FOR ELECTRONIC DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority from Japanese Patent Application Nos. 2014-045266 and 2014-045474 both filed on Mar. 7, 2014, the entire contents of which are incorporated herein by reference.

FIELD OF INVENTION

The present invention relates to a connector for an electronic device.

RELATED ART

FIG. **8** illustrates a related art connector **100** for an electric device **200**. The connector **100** includes a connector housing **110** connected to one end **211** (the upper end in FIG. **8**) of a housing **210** of the electronic device **200**, and a linear conductor **120** which serves as a terminal fitting supported by the connector housing **110** (see, e.g., JP 2011-258422A).

In the electronic device **200**, a circuit board **220** is mounted in an internal space of the housing **210** on a side of the end **211**. In addition, a relay terminal **230** is mounted in an attachment hole **214** extending through a partition wall **213** on the end **211**.

Although not shown, a first component is mounted on the other end **212** (the lower end in FIG. **8**) of the housing **210** on a side opposite to the other end **211**, and a second component is mounted on the circuit board **220** so as to be disposed coaxially with the first component.

The electronic device **200** is, for example, an in-vehicle camera, in which case the first component mounted on the end **212** of the housing **210** is a lens of the camera, and he second component mounted on the circuit board **220** coaxially with the first component is an image sensor configured to capture light incident thereon through the lens (the first component).

A contact portion **221** as an output terminal portion of the second component (e.g., the image sensor) is mounted on a surface of the circuit board **220** that faces a relay terminal **230**.

The relay terminal **230** is held between the contact portion **221** and the linear conductor **120** and electrically couples the contact portion **221** and the linear conductor **120** to each other. The relay terminal **230** includes a columnar rubber **231** tightly fitted into the attachment hole **214**, and a conductor component **232** which is embedded and mounted in the rubber **231**. The conductor component **232** is an assembly of a large number of granular conductors **232***a*. The conductor component **232** is configured to be able to expand and to shrink in an axial direction (the direction Y**1** in FIG. **8**). Thus, the conductor component **232** can absorb an error of a distance between the linear conductor **120** and the contact portion **221** caused by an assembly error or the like.

In the electronic device **200**, the circuit board **220** is fixed to the housing **210** rigidly by locking projections. Therefore, in order to surely bring the linear conductor **120** into contact with the contact portion **221** of the circuit board **220**, it is necessary to position and connect the connector **100** with respect to the electronic device **200** accurately to thereby align the axial center of the connector **100** with the axial center of the electronic device **200**. Accordingly, it is not easy to assemble the connector **100** and the electronic device **200**.

SUMMARY

Illustrative aspects of the present invention provide a connector that does not require high accuracy in positioning its contact point with respect to a contact point of an electronic device.

According to an illustrative aspect of the present invention, a connector for an electronic device is provided. The connector includes a connector housing adapted to be connected to the electronic device, a terminal fitting held by the connector housing, the terminal fitting being electrically coupled to a contact portion of the electronic device when the connector housing is connected to the electronic device, and a relay terminal adapted to be held between a distal end of the terminal fitting and the contact portion of the electronic device when the connector housing is connected to the electronic device. The relay terminal includes an electrically-insulating member and an electrically-conductive portion. The electrically-conductive portion includes a conductor provided on the electrically-insulating member to electrically couple the contact portion of the electronic device and the terminal fitting to each other. The conductor extends in a direction intersecting a center axis of the connector in a state in which the conductor is in contact with at least one of the contact portion of the electronic device and the terminal fitting.

Other aspects and advantages of the invention will be apparent from the following description, the drawings and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a connector and an electronic device according to an exemplary embodiment of the invention;

FIG. **2** is another exploded perspective view of the connector and the electronic device viewed from another angle;

FIG. **3** is a vertical sectional view of the connector and the electronic device;

FIG. **4** is another vertical sectional view of the electronic device connector and the electronic device, illustrating a state in which the electronic device connector and the electronic device are connected to each other;

FIG. **5** is a perspective view of a relay terminal of the connector;

FIG. **6** is an exploded perspective view of a connector and an electronic device according to a comparative example;

FIG. **7** is a perspective view illustrating a cross section of the electronic device connector and the electronic device shown in FIG. **6**; and

FIG. **8** is a vertical sectional view of a related art connector and an electronic device.

DETAILED DESCRIPTION

Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the drawings. However, the following exemplary embodiments do not limit the scope of the claimed invention.

FIGS. **1** to **5** show an electronic device connector **30** according to an exemplary embodiment of the present invention.

As shown in FIGS. **1** to **3**, a connector **30** includes a connector housing **31** adapted to be connected to an end **411** (the left end in FIG. **3**) of a housing **41** of an electronic device **40**, a terminal fitting **32** held by the connector housing **31**, and a relay terminal **33** which is mounted in a distal end of the terminal fitting **32**. A seal packing **43** made of rubber is

attached to the end **411** of the housing **41**. The connector housing **31** is connected to the other end of the housing **41** through the seal packing **43** so as to be waterproofed.

Before describing the configuration of the connector **30** in detail, the configuration of the electronic device **40** will be described first.

The electronic device **40** shown in an exemplary embodiment has a circuit board **42** mounted in an internal space of the housing **41** on a side of the end **411**.

As shown in FIG. **3**, the housing **41** includes a peripheral wall portion **412** substantially shaped like a rectangular cylinder, and a front end wall portion **413** closing one side (the right side in FIG. **3**) of the peripheral wall portion **412**.

The end **411** of the housing **41** is an end portion of the peripheral wall portion **412** located on a side opposite to the front end wall portion **413**. An outer end face of the front end wall portion **413** located on the side opposite to the end **411** serves as an end **415** of the housing **41**.

In the case of the electronic device **40** according to the exemplary embodiment, the circuit board **42** includes two circuit boards **421**, **422** which are spaced from each other in a longitudinal direction of a center axis O1 of the electronic device **40**. The circuit boards **421**, **422** are parallel to each other and assembled in the housing **41** in a direction in which surfaces of these two circuit boards **421**, **422** are perpendicular to the center axis O1.

The circuit boards **421**, **422** are connected to each other through a not-shown coupling unit so as to stand face to face with each other with a predetermined clearance L2. The circuit boards **421**, **422** are assembled into one component in the housing **41**.

As shown in FIG. **3**, in the electronic device **40** according to the exemplary embodiment, a first component **44** is provided at the end **415** of the housing **41** and a second component **45** is mounted on the circuit board **421** located on a side of the end **415**.

The electronic device **40** according to the exemplary embodiment is configured as an in-vehicle camera. The first component **44** is a lens. The second component **45** is an image sensor configured to convert light incident thereon through the lens into a video signal. Contact portions (not shown) serving as output terminal portions of the second component **45** are provided on an outer surface **422***a* (the surface facing the connector **30**) of the circuit board **422** located on a side of the end **411** of the housing **41**. The terminal fitting **32** of the connector **30**, which will be described later, is electrically coupled to the contact portions of the outer surface **422***a* of the circuit board **422** so that the terminal fitting **32** can receive an output signal of the second component **45**. The first component **44** and the circuit board **422** are surrounded by an electromagnetic shield member **418**.

The first component **44** and the second component **45** of the electronic device **40** are arranged such that their center axes are aligned coaxially with each other.

According to this exemplary embodiment, a board reference surface **417** for positioning the circuit board **42** is provided in the housing **41**. When the board reference surface **417** abuts against a component mounting face **421***a* of the circuit board **42** on which the second component **45** is mounted, the circuit board **42** is positioned so that the second component **45** can be disposed perpendicularly to the center axis (the optical axis) of the first component **44** and the center axis of the second component **45** can be aligned with the center axis of the first component **44**. The board reference surface **417** serves as a second component reference surface to substantially position the second component.

That is, when the circuit board **42** is biased and pressed toward the end **415** of the housing **41**, the board reference surface **417** of the housing **41** abuts against the component mounting face **421***a* of the circuit board **421**. Thus, the circuit board **42** is positioned so that the center axis of the second component **45** can be aligned with the center axis of the first component **44**.

In the case of the exemplary embodiment, the circuit board **42** is fixed to the housing **41** not rigidly by locking projections or the like but with a slight clearance so that the circuit board **42** can be made to abut against the board reference surface **417** by a pressing force acting on the circuit board **42** from the relay terminal **33** which will be described later. Thus, the circuit board **42** can be positioned in the housing **41**.

Next, the configuration of the connector **30** will be described in detail. The connector housing **31** of the connector **30** is an integral molded article made of an insulating resin. The connector housing **31** includes a flange portion **311** connected to the end **411** of the housing **41**, a terminal retaining portion **312** formed in a central portion of the flange portion **311**, and a cylindrical cable receiving portion **313** extending rearward (leftward in FIG. **3**) from the terminal retaining portion **312**.

The flange portion **311** of the connector housing **31** is fixed to the end **411** of the housing **41** by a not-shown fastening or lock unit.

The cable receiving portion **313** is a portion where an end portion of a shield cable connected to the terminal fitting **32** is received.

As shown in FIG. **3**, the terminal fitting **32** is a shield terminal including an internal conductor **321**, an external conductor **322**, and a dielectric **323**. The internal conductor **321** is made of metal and electrically coupled to the not-shown contact portion on the circuit board **422**. The external conductor **322** is shaped like a cylinder surrounding the outer circumference of the internal conductor **321**. A gap between the internal conductor **321** and the external conductor **322** is filled with the dielectric **323**. A shield braid etc. of a shield cable to be connected to the terminal fitting **32** is connected to the external conductor **322**.

A distal end portion **321***a* of the internal conductor **321** is a portion which is electrically coupled to the contact portion on the circuit board **422**. As shown in FIG. **3**, the internal conductor **321** is fixed to the terminal retaining portion **312** by a silicon potting **324**. The internal conductor **321** is fixed to the terminal retaining portion **312** in the state in which the distal end portion **321***a* of the internal conductor **321** protrudes from the surface of the flange portion **311**. In addition, since the silicon potting **324** is applied, the terminal retaining portion **312** is waterproofed.

As shown in FIG. **4**, in the connector **30** according to the exemplary embodiment, when the connector housing **31** is connected to the end **411** of the housing **41**, the internal conductor **321** of the terminal fitting **32** and a distal end portion **322***a* of the external conductor **322** are electrically coupled to the contact portions (not shown) of the second component **45** on the circuit board **42** through the relay terminal **33**.

The relay terminal **33** is held between the distal end of the terminal fitting **32** and the contact portions of the second component **45** when the connector housing **31** is connected to the end **411** of the housing **41**. As shown in FIG. **5**, the relay terminal **33** includes an electrically-insulating elastic material layer **331** (an example of an electrically-insulating member) and conductive pattern layers **322** (an example of conductors) overlaid on the surface of the electrically-insulating elastic material layer **331**.

Foaming sponge of an insulating resin molded into a predetermined shape is formed as the electrically-insulating elastic material layer **331**. The electrically-insulating elastic material layer **331** is held between the distal end of the terminal fitting **32** and the contact portions of the second component **45** so as to be elastically deformed in the direction X1 in FIGS. **1** and **5**. Thus, the electrically-insulating elastic material layer **331** biases the circuit board **42** toward the end **415** of the housing **41**.

As shown in FIG. **5**, the electrically-insulating elastic material layer **331** according to the exemplary embodiment has at least one lateral surface formed as a convex arc surface **331***c* smoothly connecting a surface **331***a* of the electrically-insulating elastic material layer **331** that faces the contact potion and a surface **331***b* of the electrically-insulating elastic material layer **331** that faces the terminal fitting **32** to each other.

The conductive pattern layers **332** are overlaid on the surface of the electrically-insulating elastic material layer **331** to electrically couple the contact portions on the second component **45** and the terminal fitting **32** to each other in a reliable manner The plurality of conductive pattern layers **332** forms an electrically-conductive portion.

Each of the conductive pattern layers **332** according to the exemplary embodiment includes a contact portion contacting pattern **332***a*, a terminal contacting pattern **332***b*, and an arc portion pattern **332***c*. The contact portion contacting pattern **332***a* overlaid on the surface **331***a* of the electrically-insulating elastic material layer **331** that faces the contact portion. The terminal contacting pattern **332***b* overlaid on the surface **331***b* of the electrically-insulating elastic material layer **331** that faces the terminal fitting **32**. The arc portion pattern **332***c* is overlaid on the convex arc surface **331***c* to connect the contact portion contacting pattern **332***a* and the terminal contacting pattern **332***b* to each other.

A large number of the conductive pattern layers **332** are formed at a given pitch. The distal end portion **321***a* of the internal conductor **321** and the distal end portion **322***a* of the external conductor **322** are electrically coupled to the respective contact portions of the circuit board **422** through the conductive pattern layers **332**. Thus, even if the distal end portion **321** a of the internal conductor **321** and the distal end portion **322***a* of the external conductor **322** are slightly displaced from the respective contact portions of the circuit board **422** in a direction perpendicular to the center axis O1 (the direction perpendicular to the up-down direction and to the surface of the sheet of FIG. **3**), the distal end portion **321***a* of the internal conductor **321** and the distal end portion **322***a* of the external conductor **322** can be electrically coupled to the respective contact portions of the circuit board **422** surely through at least one conductive pattern layer **322**. Accordingly, high accuracy is not required for alignment of the distal end portion **321***a* of the internal conductor **321** and the distal end portion **322***a* of the external conductor **322** with the respective contact portions of the circuit board **422**, in other words, for alignment between the connector **30** and the electronic device **40**. Thus, assembling work is improved.

As the relay terminal **33** according to the exemplary embodiment, for example, a GB-U type connector made by Shin-Etsu Polymer Co., Ltd. may be used.

The relay terminal **33** may be secured in position on the circuit board **422** in advance by an adhesive agent so that the relay terminal **33** does not accidentally move when attaching the connector housing **31** to the end **411** of the housing **41**, thereby improving the work for connecting the connector **30** and the electronic device **40** to each other.

According to the aforementioned configuration of the connector **30** according to the exemplary embodiment, when the connector housing **31** is connected to the end **411** of the housing **41** of the electronic device **40**, the relay terminal **33** is held between the terminal fitting **32** of the connector **30** and the contact portions on the circuit board **42** inside the electronic device **40** to electrically couple the terminal fitting **32** inside the connector **30** the contact portions on the circuit board **42** inside the electronic device **40** to each other through the conductive pattern layers **332** on the surface of the relay terminal **33**.

With the relay terminal **33** being held between the terminal fitting **32** of the connector **30** and the contact portions on the circuit board **42** inside the electronic device **40**, the electrically-insulating elastic material layer **331** is elastically deformed in a compression state so that an biasing force pressing the circuit board **42** toward the end **415** of the housing **41** is produced due to a restoring force caused by the elastic deformation. Therefore, the circuit board **42** is pressed against the board reference surface **417** of the housing **41**. By the positioning performance achieved by the board reference surface **417**, the center axis of the second component **45** mounted on the circuit board **42** can be positioned and aligned with the center axis of the first component **44** installed in the end **415** of the housing **41**.

Accordingly, a coaxial state between the first component **44** and the second component **45** in the electronic device **40** can be obtained easily by a simple operation of connecting the connector housing **31** to the end **411** of the housing **41** of the electronic device **40**.

The relay terminal includes the electrically-conductive portion having a plurality of conductors formed at the given pitch in a direction perpendicular to the center axis of the connector. At least one of the conductors electrically couples a contact portion of the terminal fitting to the contact portion of the electronic device. Accordingly, the connector and the electronic device are electrically coupled through at least one of the conductors even when they are slightly displaced from the coaxial state.

Accordingly, it is not necessary to position the connector and the electronic device coaxially with high accuracy. Thus, assembling work is improved.

In addition, according to the configuration of the connector **30** described above, a dimension error caused by an assembly error or the like can be absorbed by elastic deformation of the electrically-insulating elastic material layer **331** of the relay terminal **33** held between the terminal fitting **32** of the electronic device connector **30** and the contact portions on the circuit board **42** inside the electronic device **40** in the state in which the connector housing **31** is connected to the end **411** of the housing **41** of the electronic device **40**. Therefore, the terminal fitting **32** inside the connector **30** and the contact portions of the second component **45** on the circuit board **42** can be electrically coupled to each other in a stable manner.

In addition, according to the configuration of the connector **30** described above, the relay terminal **33** is formed to include the electrically-insulating elastic material layer **331** and the conductive pattern layers **332** overlaid on the surface of the electrically-insulating elastic material layer **331**. Thus, the relay terminal **33** is simple in structure and easy to manufacture. Accordingly, reduction in cost can be achieved.

In addition, according to the configuration of the connector **30** described above, the electrically-insulating elastic material layer **331** of the relay terminal **33** has at least one lateral surface formed as the convex arc surface **331***c* smoothly connecting the surface of the electrically-insulating elastic material layer **331** that faces contact portion and the surface of the

electrically-insulating elastic material layer **331** that faces terminal fitting **32** to each other. Each of the conductive pattern layers **332** overlaid on the surface of the electrically-insulating elastic material layer **331** includes the contact portion contacting pattern **332***a*, the terminal contacting pattern **332***b* and the arc portion pattern **332***c*. The contact portion contacting pattern **332***a* is overlaid on the surface of the electrically-insulating elastic material layer **331** on a side of the contact portion. The terminal contacting pattern **332***b* is overlaid on the surface of the electrically-insulating elastic material layer **331** on a side of the terminal fitting **32**. The arc portion pattern **332***c* is overlaid on the convex arc surface **331***c* to connect the contact portion contacting pattern **332***a* and the terminal contacting pattern **332***b* to each other.

Therefore, when the relay terminal **33** is held between the distal end of the terminal fitting **32** and the contact portions of the second component **45** to cause a change in the thickness of the electrically-insulating elastic material layer **331**, each of the conductive pattern layers **332** has no acute bent portion in which stress concentration would otherwise easily occur, but the arc portion pattern **332***c* can be deformed easily. In this manner, locally extreme bending deformation can be prevented from occurring.

Therefore, even when the relay terminal **33** is elastically deformed repeatedly, fatigue hardly remains in the conductive pattern layers **332** so that it is possible to improve reliability and durability of the connection between the terminal fitting **32** inside the connector housing **31** and the contact portions of the second component **45**.

FIGS. **6** and **7** show a connector **30**A as a comparative example. The connector **30**A adapted to be connected to an end **411** of a housing **41** of an electronic device **40**A (e.g., the in-vehicle camera described above). However, spring terminal fittings **51**, **52** are used in place of the relay terminal **33**. In addition, in the electronic device **40**A, a circuit board **42** mounted with a second component **45** is fixed to the housing **41** by engagement using locking projections provided on an inner side of the housing **41**.

Common elements of the connector **30**A and the electronic device **40**A to those of the connector **30** and the electronic device **40** according to the exemplary embodiment will be denoted by the same reference signs and description thereof will be therefore omitted.

Each of the spring terminal fittings **51**, **52** is shaped like a plate spring by bending a metal plate into an L-shape. The spring terminal fittings **51**, **52** are provided and fixed to distal ends of an internal conductor **321** and an external conductor **322** of a terminal fitting **32** shown in the aforementioned exemplary embodiment by solders **60**.

When a flange portion **311** of the connector housing **31**A of the connector **30**A is connected to the end **411** of the housing **41** in the electronic device **40**A, the spring terminal fittings **51**, **52** make contact with contact portions of a circuit board **422** (see FIG. **7**) inside the electronic device **40**A in the state in which distal end portions of the spring terminal fittings **51**, **52** are elastically deformed. Thus, the internal conductor **321** and the external conductor **322** inside the connector **30**A are electrically coupled to the contact portions on the circuit board **422**.

In the case of the comparative example, the circuit board **42** in the electronic device **40**A is fixed to the housing **41** by locking projections. In this structure, there is a fear that the circuit board **42** may be positioned loosely due to a dimension tolerance or an assembly error to make it difficult to align the center axis of the second component **45** with the center axis of a first component **44**.

In addition, in the configuration of the comparative example, variation may be generated easily in mounting accuracy of the spring terminal springs **51**, **52** due to variation in the solders for the spring terminal terminals **51**, **52**. In addition, it takes time and labor in the soldering work, which makes it difficult to improve the productivity of the connector **30**A.

In contrast, the problem occurring in the connector **30**A can be avoided in the connector **30** according to the exemplary embodiment described above.

While the present invention has been described with reference to certain exemplary embodiments thereof, the scope of the present invention is not limited to the exemplary embodiments described above, and it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the scope of the present invention as defined by the appended claims.

For example, the relay terminal may have a configuration in which conductive pattern layers are overlaid on the surface of an electrically-insulating elastic material layer having a cylindrical body, a cross section of which being true circular, elliptical, rectangular, triangular or polygonal. Alternatively, the relay terminal may have a configuration in which a conductor is embedded in the cylindrical body having a circular, elliptical, rectangular, triangular or polygonal cross section so as to extend from one side to the other side of the cylindrical body.

With the relay terminal being deformable, it is preferable that the conductive pattern layers of the relay terminal be overlaid on a curved surface as in the exemplary embodiment described above so that the conductive pattern layers can be flexibly deformed easily without being damaged.

In addition, although the conductors of the relay terminal are formed in a direction perpendicular to the center axis in the exemplary embodiment described above, the conductors may be formed in a direction intersecting the center axis. The conductors may make contact with the contact portions not in a state where the conductors are perpendicular the center axis but in a state where the conductors are inclined to the center axis. In addition, the conductors may make contact with the contact portions in a state where the conductors are inclined on their one sides.

In addition, although the exemplary embodiment has a configuration in which the relay terminal is held between the terminal fitting of the connector and the contact portions of the electronic device, the relay terminal may be fixed to one of the electronic device and the electronic device connector.

In addition, although the plurality of conductive pattern layers of the relay terminal are formed in the exemplary embodiment described above, there may be only one conductive pattern layer when, for example, the electronic device has only one contact portion.

In addition, although the second component is an image sensor provided in the circuit board in the exemplary embodiment described above, the image sensor as the second component may not be provided on the circuit board. The image sensor may be provided inside the housing without being mounted on the circuit board.

In addition, the electronic device in which the connector according to the invention is used is not limited to an in-vehicle camera shown in the exemplary embodiment. Any electronic device may be used as long as the connector according to the exemplary embodiment can be connected to the electronic device. For example, the connector according to the exemplary embodiment may be also used in any of various electronic devices having a configuration in which the center axis of a second component on a circuit board provided

on one side of a housing needs to be aligned with the center axis of a first component on the other side of the housing, or used in any electronic device having a configuration in which a second component is mounted to be inclined to a first component.

According to exemplary embodiments of the present invention, a connector (**30**) for an electronic device (**40**) is provided. The connector includes a connector housing (**31**) adapted to be connected to the electronic device (**40**), a terminal fitting (**32**) held by the connector housing (**31**), the terminal fitting (**32**) being electrically coupled to a contact portion of the electronic device (**40**) when the connector housing (**31**) is connected to the electronic device (**40**), and a relay terminal (**33**) adapted to be held between a distal end of the terminal fitting (**32**) and the contact portion of the electronic device (**40**) when the connector housing (**31**) is connected to the electronic device (**40**). The relay terminal (**33**) includes an electrically-insulating member (**331**) and an electrically-conductive portion. The electrically-conductive portion has a conductor (**332**) is provided on the electrically-insulating member (**331**) to electrically couple the contact portion of the electronic device (**40**) and the terminal fitting (**32**) to each other. The conductor extends in a direction intersecting a center axis of the connector (**30**) in a state in which the conductor is in contact with at least one of the contact portion of the electronic device (**40**) and the terminal fitting (**32**).

The direction in which the conductor (**332**) extends may be perpendicular to the center axis of the connector (**30**).

The conductor (**332**) may be overlaid on a surface of the electrically-insulating member (**331**)

The electrically-conductive portion may have a plurality of conductors (**332**) arranged at a given pitch in another direction intersecting the center axis of the connector (**30**), so that at least one of the conductors (**332**) electrically couples the terminal fitting (**32**) and the contact portion of the electronic device (**40**) to each other.

The electrically-insulating member (**331**) of the relay terminal (**33**) may have elasticity.

The electrically-insulating member (**331**) of the relay terminal (**33**) may have at least one lateral surface formed as a convex arc surface (**331***c*) smoothly connecting a surface of the electrically-insulating member (**331**) that faces the contact portion and a surface of the electrically-insulating member (**331**) that faces the terminal fitting to each other. The electrically-conductive portion may include a contact portion contacting pattern (**332***a*), a terminal contacting pattern (**332***b*) and an arc portion pattern (**332***c*), the contact portion contacting pattern (**332***a*) being overlaid on the surface of the electrically-insulating member (**331**) that faces the contact portion, the terminal contacting pattern (**332***b*) being overlaid on the surface of the electrically-insulating member (**331**) that faces the terminal fitting, and the arc portion pattern (**332***c*) being overlaid on the convex arc surface (**331***c*) to connect the contact portion contacting pattern (**332***a*) and the terminal contacting pattern (**332***b*) to each other.

The electronic device (**40**) may include a first component (**44**) provided at one end (**415**) of a device housing (**41**) and a second component (**45**) provided on a side of the other end (**411**) of the device housing (**41**), the second component (**45**) being arranged coaxially with the first component (**44**). The device housing (**41**) may have a second component reference surface (**417**) configured to position the second component (**45**) when the second component (**45**) is biased and pressed toward the one end of the housing (**41**) such that a center axis of the second component (**45**) is coaxially aligned with a center axis of the first component (**44**). The relay terminal (**33**) may be held between a distal end of the terminal fitting (**32**) and the contact portion of the second component (**45**) so that the relay terminal (**33**) is elastically deformed to bias the second component (**45**) toward the one end of the housing (**41**).

The electronic device (**40**) may be an in-vehicle camera.

What is claimed is:

1. A connector for an electronic device, the connector comprising:

a connector housing adapted to be connected to the electronic device;

a terminal fitting held by the connector housing, the terminal fitting being electrically coupled to a contact portion of the electronic device when the connector housing is connected to the electronic device; and

a relay terminal adapted to be held between a distal end of the terminal fitting and the contact portion of the electronic device when the connector housing is connected to the electronic device,

wherein the relay terminal comprises an electrically-insulating member and an electrically-conductive portion, the electrically-conductive portion comprising a conductor provided on a the electrically-insulating member to electrically couple the contact portion of the electronic device and the terminal fitting to each other, the conductor extending in a direction intersecting a center axis of the connector in a state in which the conductor is in contact with at least one of the contact portion of the electronic device and the terminal fitting.

2. The connector according to claim **1**, wherein said direction in which the conductor extends is perpendicular to the center axis of the connector.

3. The connector according to claim **1**, wherein the conductor is overlaid on a surface of the electrically-insulating member.

4. The connector according to claim **1**, wherein the electrically-conductive portion comprises a plurality of said conductors arranged at a given pitch in another direction intersecting the center axis of the connector, and

wherein at least one of the conductors electrically couples the terminal fitting and the contact portion of the electronic device to each other.

5. The connector according to claim **1**, wherein the electrically-insulating member has elasticity.

6. The connector according to claim **1**, wherein the electrically-insulating member has at least one lateral surface formed as a convex arc surface smoothly connecting a surface of the electrically-insulating member that faces the contact portion and a surface of the electrically-insulating member that faces the terminal fitting to each other, and

wherein the electrically-conductive portion comprises a contact portion contacting pattern, a terminal contacting pattern and an arc portion pattern, the contact portion contacting pattern being overlaid on the surface of the electrically-insulating member that faces the contact portion, the terminal contacting pattern being overlaid on the surface of the electrically-insulating member that faces the terminal fitting, and the arc portion pattern being overlaid on the convex arc surface to connect the contact portion contacting pattern and the terminal contacting pattern to each other.

7. The connector according to claim **1**, wherein the electronic device comprises a first component provided at one end of a device housing and a second component provided on a side of the other end of the device housing, the second component being arranged coaxially with the first component,

wherein the device housing comprises a second component reference surface configured to position the second component when the second component is biased and pressed toward the one end of the device housing such that a center axis of the second component is aligned coaxially with a center axis of the first component, and

wherein the relay terminal is held between a distal end of the terminal fitting and the contact portion of the second component so that the relay terminal is elastically deformed to bias the second component toward the one end of the device housing.

8. The connector according to claim **1**, wherein the electronic device is an in-vehicle camera.

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